

B. Claims

The following is a complete listing of the claims, and replaces all earlier versions and listings.

1. (Currently Amended) A fabrication method of a mold for a microlens having a desired radius (R) of curvature, said the method comprising the steps of:

(a) preparing a substrate at least a portion of which is electrically conductive;

(b) forming an insulating mask layer on the conductive portion of the substrate such that the insulating mask layer has an opening to expose the conductive portion of the substrate, a diameter or width (ϕ) of the opening being $10\mu\text{m} \leq \phi \leq 0.35R$ and $R \leq 200\mu\text{m}$;

(c) forming an opening in the mask layer to expose the conductive portion of the substrate at the opening such that a diameter or width (ϕ) of the opening is $10\mu\text{m} \leq \phi \leq 0.35R$ and $R \leq 200\mu\text{m}$;

(d) performing electroplating to form the mold with the desired radius (R) of curvature using the conductive portion of the substrate as a cathode to deposit a plated layer portion in the opening and on the mask layer; and

(e)(d) terminating electroplating when the electroplated layer portion reaches the desired radius (R) of the curvature after forming a minimum radius (R_{\min}) of curvature;

(e) forming a sacrificial layer on the plated portion;

(f) forming an electrode layer on the sacrificial layer; and

(g) forming a plated portion used as the mold on the electrode layer by electroplating by using the electrode layer as a cathode, wherein the desired radius (R) of curvature and the minimum radius (R_{min}) are radii at an optical axis of the plated portion.

2-6. (Cancelled)

7. (Currently Amended) The method according to claim 1, wherein ~~said the~~ step (d)(c) comprises causing a current to flow between the cathode and an anode plate in an electroplating bath and ~~said the~~ step (e)(d) comprises ending the current flow.

8. (Cancelled)

9. (Currently Amended) A fabrication method of a microlens having a desired radius (R) of curvature, ~~said the~~ method comprising the steps of:

(a) preparing a substrate at least a portion of which is electrically conductive;

(b) forming an insulating mask layer on ~~the conductive portion of the~~ substrate such that the insulating mask layer has an opening to expose the conductive portion of the substrate, a diameter or width (φ) of the opening being $10\mu\text{m} \leq \phi \leq 0.35R$ and $R \leq 200\mu\text{m}$:

(c) forming an opening in the mask layer to expose the conductive portion of the substrate at the opening such that a diameter or width (ϕ) of the opening is $10\mu\text{m} \leq \phi \leq 0.35R$ and $R \leq 200\mu\text{m}$;

(d) performing electroplating using the conductive portion of the substrate as a cathode to deposit a plated layer portion in the opening and on the mask layer;

(e) terminating electroplating when the plated layer portion reaches the desired radius (R) of curvature after forming a minimum radius (R_{\min}) of curvature;

(f) forming a sacrificial layer on the plated portion;

(g) forming an electrode layer on the sacrificial layer;

(h) forming a plated portion used as the mold on the electrode layer by electroplating by using the electrode layer as a cathode;

(i) separating the mold from the substrate by etching the sacrificial layer;

(j) forming a lens material on the mold; and

(k) separating the lens material from the mold,

wherein the desired radius (R) of curvature and the minimum radius (R_{\min}) are radii at an optical axis of the plated portion.